

The antimicrobial effect of some disinfectants to reduce the contamination of toothbrushes

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ABSTRACT

Background: Tooth caries is parts of teeth that have rotting that can develop into small or large holes gradually. Caries, also called tooth decay, is the result of several causes and factors combined, including unclean teeth, lack of care for cleaning teeth, eating sweets, sugar, and sugary drinks. The bacteria may go up to 1.8 m in the air and pollution toothbrushes in the bathroom and lead to the accumulation and stability of bacteria above toothbrushes and when used toothbrushes the bacteria transmitted directly to the mouth. **Materials and Methods:** A total of 100 samples were collected from patients (50 from patients with teeth decay and 50 from patients with gingivitis) using clean and sterile swaps, then choice 24 volunteers were selected from patients who suffered from teeth decay and gingivitis, and 48 new toothbrushes were purchased from local markets. Ten volunteers were put the toothbrushes, one outside the bathroom and another inside the bathroom for 10 days and 12 volunteers divided into four groups were put the one toothbrush in and another without disinfectants for 2 weeks. **Results:** The results showed that the number of positive samples isolated from tooth decay was 32 from 50 samples, while the number of positive samples isolated from gingivitis was 27 from 50 samples. The results display that, the crest toothpaste the most effective toothpaste compared with other types used by patients with tooth decay. The result showed the percentage of positive samples isolated from the patient used electric toothbrushes suffered from teeth decays was 25% less than the percentage of positive samples isolated from the patient used manual toothbrushes was 58.8%. When compared the colony forming unit between the brush placed outside and inside the bathroom found that the number of colony forming unit for all the toothbrush placed outside the bath was much lower than that placed inside. **Conclusion:** The current study concludes that it is better to keep the toothbrush in a dry place away from the bathroom to avoid contamination of microorganisms and also clarified the possibility of using some sterile materials to reduce the contamination of toothbrush and thus reduces the diseases of tooth decay and gingivitis.

KEY WORDS: Dental caries, Tooth decay, Toothpaste, Toothbrush, Gingivitis

INTRODUCTION

Tooth caries is parts of teeth that have rotting that can develop into small or large holes gradually. Caries, also called tooth decay, is the result of several causes and factors combined, including unclean teeth, lack of care for cleaning teeth, eating sweets, sugar, and sugary drinks. Tooth decay is one of the most common health problems around the world.^[1] It is widespread, mainly among children and adolescents, but every person in his mouth teeth may get decay. If tooth decay is not treated, the holes may enlarge and widen causing severe pain, inflammation, even tooth loss, and other complications.^[2]

Gingivitis, sometimes called gum disease or periodontal disease, describes cases of bacterial buildup in the oral cavity, which in the end, if untreated, can lead to loss of teeth, as a result of damage to the layer that encapsulates the teeth.^[3] The toilet flushing water will leads to spreading the bacteria in the air and deposited on top of things and the tools in the bathroom like toothbrushes.^[4] The bacteria may go up to 1.8 m in the air and pollution toothbrushes in the bathroom and lead to the accumulation and stability of bacteria above toothbrushes and when used toothbrushes the bacteria transmitted directly to the mouth.^[5] The researchers said that about 100 million bacteria can live on the toothbrushes in the bathroom, including *Escherichia coli*, *Staphylococcus*, and *Candida*.^[6] The goal of brushing teeth is remove dental plaque, reduced gingival inflammation, remove stains and pigmentation, disposal dental calculus, reduce

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gingival trauma, and cleaning surfaces of the teeth in difficult areas and distant areas between the years.^[7]

This study was aimed to investigate the best disinfectants to reduce the bacterial contamination of the toothbrush.

MATERIALS AND METHODS

Isolation and Identification of Bacteria from Teeth Decay and Gingivitis

A total of 100 samples were collected from patients (50 from patients with teeth decay and 50 from patients with gingivitis) using clean and sterile swaps. The patients using different types of toothpaste (Crest, Sensodyne, Sanino, Colgate, and Signal). Only 16 from 50 patients suffering from teeth decay and 12 from 50 patients suffering from gingivitis used electric toothbrush. Then, the samples transferred directly to the microbiology laboratory for the initial diagnosis of bacteria by inoculation the samples on the appropriate media (blood agar Chocolate agar, and MacConkey's agar) and incubated in aerobic and anaerobic conditions at 37°C for 24–48.^[8]

Isolation and Identification of Bacteria from Toothbrush

Twenty new toothbrushes were purchased from local markets and 10 volunteers were selected from patients who suffered from tooth decay and gingivitis. Each of them was given two toothbrushes for daily use. One of them was placed inside the bathroom and the other outside the bathroom for 10 days. At the end of the period, the toothbrush was collected and transported to the laboratory in the sterile bag. The handle of brush was cut off using heat sterile scissors; head of the brush was then soaking in 10 ml of sterile tryptone soya broth, for 60 min, followed by vortex mixing for 1 min and make swabbing to dislodge suspected adherent bacteria. The bacterial suspension was one-fold diluted for 10–1 and 0.1 ml of broth plated by pipette into appropriate media (blood agar, Chocolate agar, and MacConkey's agar) and incubated in aerobic and anaerobic conditions at 37°C for 24–48, to compare between the number of bacterial colonies and bacterial strains isolated between the brush placed outside and inside the bathroom.^[9]

Effect of Disinfectants to Reduce Toothbrushes Contamination

Twenty-four toothbrushes were purchased from local markets and were given to 12 volunteers suffering from dental caries to daily use for 2 weeks. They were divided into four groups; each group consists of three people who were given a solution of:

- Group 1: 1% sodium hydrochloride
- Group 2: 3% hydrogen peroxide
- Group 3: White vinegar
- Group 4: Lemon juice.

To put one of the brushes in the solution and the other outside the solution during the daily use for 2 weeks, to comparative bacterial contamination of teeth brushes stored in different settings before and after using different type of disinfection the teeth brushes.^[10]

RESULTS AND DISCUSSION

There is a developing enthusiasm for oral cleanliness the executives for a healthy oral condition. The toothbrush is the most well-known instrument used to improve the oral well-being of a person. Toothbrushing evacuates dental plaque, massages the gums, and keeps up cleanliness in the mouth, in this way assuming a significant job in the anticipation of dental caries and periodontal diseases.^[11] The results showed that the number of positive samples isolated from tooth decay was 32 in the rate of 64% from 50 samples, while the number of positive samples isolated from gingivitis was 27 in the rate of 54% from 50 samples [Table 1]. The result different than the result obtained by Jabuk *et al.*, 2015,^[1] when present the ratio of the positive sample of tooth decay and gingivitis was 38%. This difference may be due to the number of samples, the time period for completing the research, the difference in the diagnostic methods used, environmental conditions of the sites of these studies, and the difference in patient age.^[12]

The results revealed that crest toothpaste the most effective toothpaste compared with other types used by patients with tooth decay as shown in Table 2. The same result obtained by Jabuk, 2016,^[4] also present that the crest toothpaste was more effective than another type of toothpaste by inhibition the growth all type of bacteria isolated from teeth decay.

The result showed the percentage of positive samples isolated from the patient used electric toothbrushes suffered from teeth decays was 25% less than the percentage of positive samples isolated from the patient used manual toothbrushes was 58.8%, and present the percentage of positive samples isolated from the patient used electric toothbrushes suffered from gingivitis was 33.4% less than the percentage of positive samples isolated from the patient used manual toothbrushes was 47.4% [Table 3]. The same result obtained by Re *et al.*, 2015,^[13] also presents

Table 1: The number and percentage of positive and negative samples isolated from teeth decay and gingivitis

Type of samples	Number and percentage of positive and negative samples		n (%)
Teeth decay	+	(%) 32 (64)	50 (100)
	-	(%) 18 (36)	
Gingivitis	+	(%) 27 (54)	50 (100)
	-	(%) 23 (46)	

Table 2: Number and percentage of positive and negative samples according to the type of toothpaste used

Type of toothpaste	Teeth decay		Gingivitis	
	Number of positive samples (%)	Number of negative samples (%)	Number of positive samples (%)	Number of negative samples (%)
Crest	1 (2)	9 (18)	2 (4)	8 (16)
Sensodyne	9 (18)	1 (2)	5 (10)	5 (10)
Sanino	7 (14)	3 (6)	5 (10)	5 (10)
Colgate	7 (14)	3 (6)	6 (12)	4 (8)
Signal	8 (16)	2 (4)	9 (18)	1 (4)
Total	32 (64)	18 (36)	27 (54)	23 (46)
	50 (100)		50 (100)	

Table 3: Number and percentage of positive and negative samples according to the type toothbrushes used

Type of toothbrushes	Tooth decay		Gingivitis	
	Manual	Electric	Manual	Electric
Number of positive samples (%)	20 (58.8)	4 (25)	18 (47.4)	4 (33.4)
Number of negative samples (%)	14 (41.2)	12 (75)	20 (52.6)	8 (66.6)
Total	34 (100)	16 (100)	38 (100)	12 (100)

Table 4: Type and number of bacteria isolated from teeth decay, gingivitis, and toothbrush

Type of bacteria	Teeth decay	Gingivitis	Tooth brush
Aerobic Gram-positive bacteria			
<i>Staphylococcus aureus</i>	10	19	6
<i>Bacillus cereus</i>	7	6	12
<i>Staphylococcus epidermidis</i>	9	5	9
<i>Micrococcus spp.</i>	5	4	6
<i>Streptococcus mutans</i>	14	12	8
<i>Bacillus subtilis</i>	5	6	9
Aerobic Gram-negative bacteria			
<i>Klebsiella pneumonia</i>	6	3	7
<i>Proteus mirabilis</i>	8	5	8
<i>Escherichia coli</i>	3	4	17
<i>Pseudomonas aeruginosa</i>	2	3	17
Anaerobic Gram-positive bacteria			
<i>Actinomyces naeslundii</i>	5	6	9
<i>Peptostreptococcus spp.</i>	18	13	4
Anaerobic Gram-negative bacteria			
<i>Lactobacillus fermentum</i>	6	4	0
<i>Bacteroides ovatus</i>	6	4	2

the electric toothbrush more effective than manual. The advantages of electronic toothbrushes compared to manual is The electronic toothbrush lasts longer than the manual, Cleaning your teeth using requires less energy and strength, so this is more suitable for children, causes less damage to the gums and the enamel layer, because most contain pressure sensors, requires fewer skills, suitable for people with mobility difficulties needed to clean teeth due to health problems such as arthritis, The vibrations caused by the electronic toothbrush have a positive effect on the teeth not caused by the manual brush and contain a temporary, so you know what time you need to clean your teeth.^[14,15]

The disadvantages of electronic toothbrushes are, the size of the electronic toothbrush is huge, is more expensive than the manual toothbrush, and it is difficult to control the electronic toothbrush equally in the manual brush. Because it does not require much

Table 5: Number and percentage of positive and negative samples according to the preserved place of teeth brushes

Preserved place	Number and percentage of positive and negative samples		n (%)
Inside the bathroom with attached toilets	+	10 (100)	10 (100)
	-	0	
Outside the bathroom	+	7 (70)	10 (100)
	-	3 (30)	

effort, the electronic toothbrush relies on people to shake the brush and turn the bristles of the brush and fail to clean their teeth sufficiently.^[16]

The level of toothbrush pollution shifts relying on how the toothbrush was put away after day-by-day use and the toothbrush can be exceptionally contamination

Table 6: The colony-forming unit/ml of bacteria isolated from toothbrushes

Number of toothbrushes	Colony-forming unit/ml					
	Outside the bathroom			Inside the bathroom		
	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻¹	10 ⁻²	10 ⁻³
1	102	96	85	185	181	90
2	95	93	73	191	179	96
3	106	94	86	120	187	81
4	120	85	69	241	135	97
5	156	84	56	186	106	83
6	23	14	8	286	174	78
7	22	16	10	279	161	95
8	114	86	63	352	245	102
9	28	18	6	287	176	98
10	27	15	9	146	140	79

Table 7: The colony-forming unit/ml of bacteria isolated from toothbrushes with and without use disinfectants

Number of toothbrushes	Colony-forming unit/ml	
	Without	With
Sodium hydrochloride		
S1	92	25
S2	73	20
S3	87	32
Hydrogen peroxide		
H1	72	30
H2	93	22
H3	85	15
White vinegar		
W1	84	15
W2	76	20
W3	96	17
Lemon juice		
L1	75	33
L2	82	27
L3	65	34

by microorganisms as indicated by oral conditions, environment hand cleanliness, aerosol contamination, and storage container.^[17] The toothbrush is for the most part put away in the washroom, and microbes develop well under such a damp and warm condition.^[18] The toothbrush was collected from the volunteer patients after 10 days. It was found that the ratio of positive toothbrush placed inside the bathroom was 100% while the ratio of positive toothbrush placed outside the bathroom was 70% [Table 4]. When compared the colony-forming unit between the brush placed outside and inside the bathroom found that the number of colony-forming unit for all the toothbrush placed outside the bath was much lower than that placed inside it as shown in Table 5. To avoid contamination of toothbrush, you should wash your hands before and after brushing your teeth, after brushing teeth clean toothbrush under the tap water and then put them in dry place, do not cover your brush teeth in a closed container because the humid environment is a breeding ground for bacteria to grow, put the brush your teeth in place is far from the toilet, and replace your teeth brush from 3 to 4 months or less in the case of damage to the brush bristles.^[19,20] The Colony

forming unit \ ml (CFU\ml) of bacteria isolated from toothbrushes placed outside and inside the bathroom were showed in [Table 6].

The toothbrush was collected from the volunteer patients after 2 weeks. When compared the colony-forming unit between the brush placed outside and inside the sterilized solution found that the number of colony-forming unit for all the toothbrush placed inside the sterilized solution was much lower than that placed outside sterilized solution, the same result obtain by Dharmadhikari *et al.*, 2012,^[21] by using number of disinfectants to reduce the contamination of toothbrush it was present the white vinegar is more effective compare with another type of disinfectants Table 7. Basman *et al.*, 2016,^[22] also obtained the same result. The vinegar, otherwise called acidic acid, contains disinfecting properties. Vinegar is an acidic fluid that is produced using the fermentation of a mixed refreshment primarily wine.^[23] The total acidity of vinegar is communicated as acidic acid which is the major organic acid in vinegar. Acidic acid is a monocarboxylic acid. It has a sharp smell and flavor.^[24] It is generally regarded as safe for universally useful and incidental use.^[25] They diffuse through the microbes cell wall inhibition the growth of bacteria.^[25,26]

CONCLUSION

The current study concludes that it is better to keep the toothbrush in a dry place away from the bathroom to avoid contamination of microorganisms volatile from the floor of the bathroom during the process of cleaning and also clarified the possibility of using some sterile materials to reduce the contamination of toothbrush and thus reduces the diseases of tooth decay and gingivitis.

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